

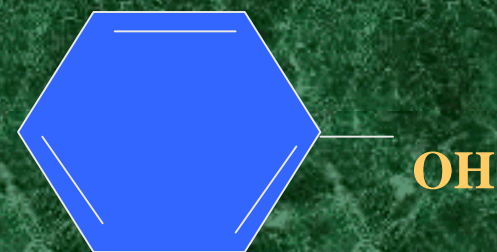
Analyzing the Health Benefits of Nebraska Grapes and Wines

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The Power of Polyphenols

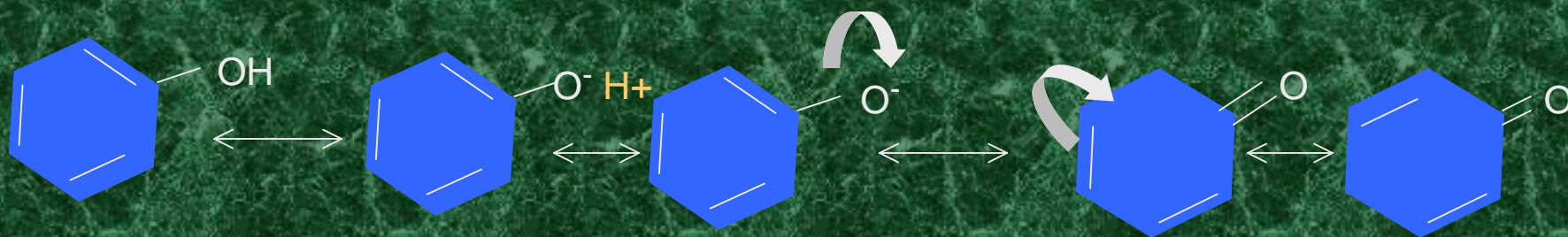
What are they good for?

PHENOL



- >100,000 Compounds
- classified according to basic skeletal structure
- acidic
- Participates in oxidation-reduction reactions

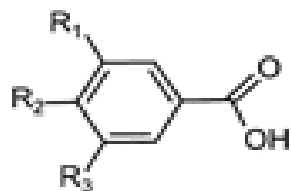
Phenol oxidation



Secondary plant metabolite

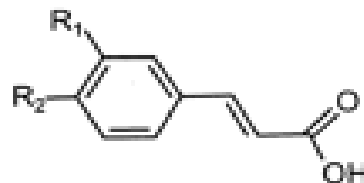
- **Product of 2° carbon metabolism**
 - not required for basic metabolism (growth & reproduction)
 - Other 2° metabolite classes: Terpenes, glycosides, alkaloids

Hydroxybenzoic acids



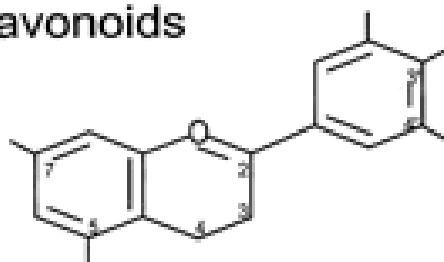
$R_1 = R_2 = OH, R_3 = H$: Protocatechuic acid
 $R_1 = R_2 = R_3 = OH$: Gallic acid

Hydroxycinnamic acids

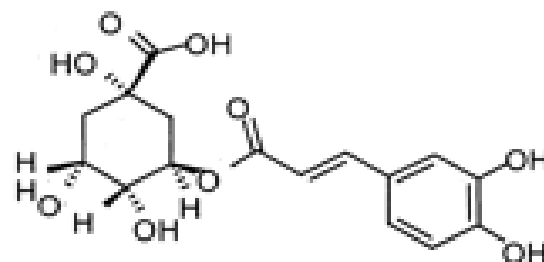


$R_1 = OH$: Coumaric acid
 $R_1 = R_2 = OH$: Caffeic acid
 $R_1 = OCH_3, R_2 = OH$: Ferulic acid

Flavonoids

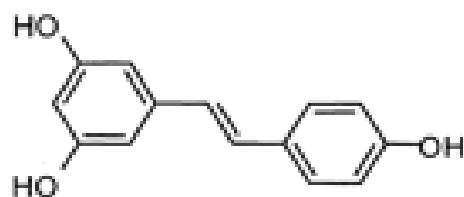


See Figure 2



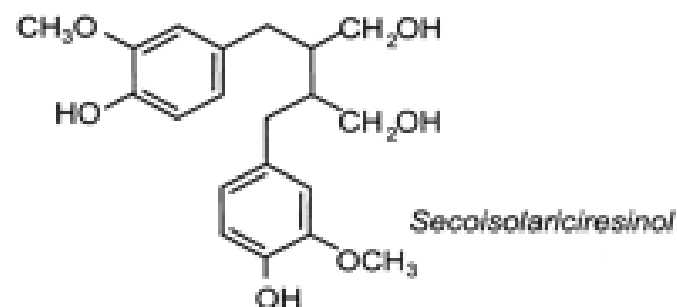
Chlorogenic acid

Stilbenes



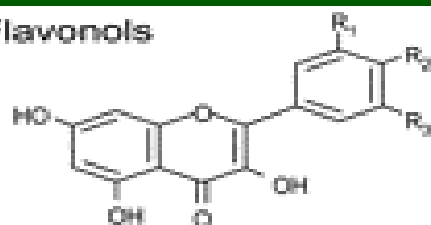
Resveratrol

Lignans



Secoisolariciresinol

Flavonols



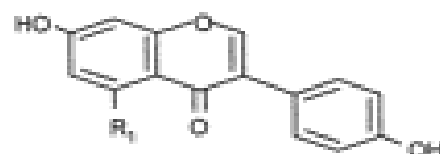
$R_2 = \text{OH}; R_1 = R_3 = \text{H}$: Kaempferol
 $R_1 = R_2 = \text{OH}; R_3 = \text{H}$: Quercetin
 $R_1 = R_2 = R_3 = \text{OH}$: Myricetin

Flavones



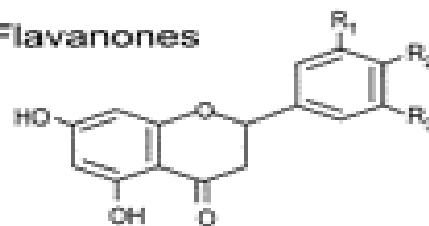
$R_1 = \text{H}; R_2 = \text{OH}$: Apigenin
 $R_1 = R_2 = \text{OH}$: Luteolin

Isoflavones



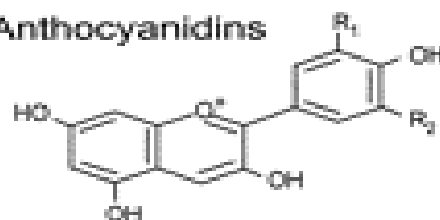
$R_1 = \text{H}$: Daidzein
 $R_1 = \text{OH}$: Genistein

Flavanones



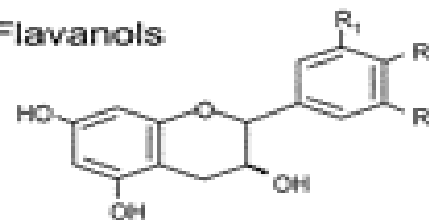
$R_1 = \text{H}; R_2 = \text{OH}$: Naringenin
 $R_1 = R_2 = \text{OH}$: Eriodictyol
 $R_1 = \text{OH}; R_2 = \text{OCH}_3$: Hesperetin

Anthocyanidins

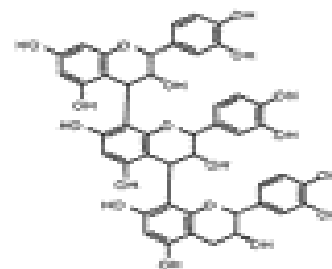


$R_1 = R_2 = \text{H}$: Pelargonidin
 $R_2 = \text{OH}; R_1 = \text{H}$: Cyanidin
 $R_1 = R_2 = \text{OH}$: Delphinidin
 $R_1 = \text{OCH}_3; R_2 = \text{OH}$: Petunidin
 $R_1 = R_2 = \text{OCH}_3$: Malvidin

Flavanols



$R_1 = R_2 = \text{OH}; R_3 = \text{H}$: Catechins
 $R_1 = R_2 = R_3 = \text{OH}$: Gallicocatechin



Trimeric procyanidin

Plant functions

- **Reduces photo-destruction – absorbs excess energy**
- **Antimicrobial**
- **Protection from herbivores**
- **Allelopathy**
- **Antioxidant**

Polyphenolic Synthesis

- Present continuously or is induced
 - Induction by phytophagic or microbial activity
- Affected by light exposure (carbon-nutrient relationship?)
- Unaffected by soil nutrients (?)
- Affected by soil water content
- Usually increases with age

Polyphenolic Classes

- **Tannins**

- bitterness, herbivore deterrence, pathogen resistance, binds protein (antinutritive),

- A. Hydrolyzable-- polymers of phenolic acids, usually gallic acid and sugars

- B. Condensed --polymers of flavonoids. Hydrolyze in strong acid to anthocyanidins

Polyphenolic Classes

- **Flavonoids**
 - Insect deterrent or attractant, feeding stimulant, signal to soil mycorrhiza, UV protection
- A. **Anthocyanidins** --delphinidin, cyanidin
 - Pigmentation
- B. **Flavonols**—Quercetin, catechin, epicatechin
 - Allelopathic functions
- C. **Stilbenes**—Resveratrol, picead
 - phytoalexin

The French Paradox

--the French have a diet relatively high in fat, as does America and other European countries, but have decreased incidence of heart disease

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Polyphenol content

	<i>Total polyphenols</i>
Red grape, <i>ave.</i>	5500 mg/kg
Red wine	700–4000 <i>mg/L</i>
White grape, <i>ave.</i>	4000 mg/kg
White wine	150-400 <i>mg/L</i>

Nebraska Grapes

- St. Croix > Frontenac > deChaunac
~4900 -1400 mg/kg whole grapes
- Vignoles & LaCrosse ~ 1400mg/kg
whole grapes

Grapes

- >200 phenolic compounds
- Seeds ~46-69%
- Stems ~22%
- Skin ~12-50%
- Pulp ~1%

Health benefits of wine

- Total phenolic content directly related antioxidant capacity (anthoyanins)
- Overall decrease in aging disease risk
- 40% decrease in risk of coronary heart disease

Vascular benefits

Quercetin, catechin, resveratrol

- Inhibition of platelet aggregation
- Inhibition of LDL oxidation (plaque)
-
- Vasodilation
- Inhibition of vasoconstriction (tannins)

Anti-carcinogenic properties

- Stilbenes inhibit cell proliferation
- Association with decreased colon cancer
- Inhibition of non-melanoma skin cancer
-resveratrol
- Estrogenic effect-resveratrol +/-

Other health benefits

- Improved lung function & lower lung disease —white wine
- Decreased dementia
- Increase in lifespan???

WINE

Processing:

- Grape juice 50% fewer polyphenols
- Red wine > Blush > White wine > Alcohol

Benefits of Alcohol

- Increases HDL levels
- May improve polyphenol absorption
- Synergism?
- Moderation only, <2 drinks daily

Benefits of Wine

- Tartaric acid-enhances the absorption of catechin in rats
- Cultural associations

For the Quiz:

- **Polyphenols
(anthocyanins)=antioxidants**
- **Grapes: The Redder the Better!**
- **Wine: Good for your health, but
ONLY IN MODERATION!**

